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IS 14442 (1997): Agricultural Produce MILLING Machinery - Burr Mill -Test Code [FAD 20: Agriculture and Food Processing Equipments]

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कृषि उत्पाद प्रेषण मशीनरी — पुचडामिल — परीक्षण संहिता

Indian Standard

AGRICULTURAL PRODUCE MILLING MACHINERY — BURR MILL — TEST CODE

ICS 67.260

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

June 1997

Price Group 4

Agricultural Produce Processing and Milling Machinery Sectional Committee, FAD 51

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Agricultural Produce Processing and Milling Machinery Sectional Committee had been approved by the Food and Agriculture Division Council.

Milling of agriculture produce to grits and flours is an essential unit operation towards making them suitable for human consumption and for feed. One of the main machinery used in the process are burr mills. In order to have a uniformity in reporting of test result of different burr mills, this test code has been developed. On the basis of laying of grinding surfaces, these mills could be either horizontal or vertical type.

In preparation of this standard assistance has been derived from Indian Council of Agricultural Research and Central Institute of Agricultural Engineering, Bhopal.

In reporting the results of a test or analysis made in accordance with the standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'.

Indian Standard

AGRICULTURAL PRODUCE MILLING MACHINERY — BURR MILL — TEST CODE

1 SCOPE

1.1 This standard prescribes method for testing of burr mills to evaluate their performance.

2 REFERENCES

2.1 The following standards contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
460 (Part 1) : 1985	Specification for test sieves: Part 1 wire cloth test sieve (*third revision*)
4333 (Part 2) : 1967	Method of analysis of food grains: Part 2 Moisture
9981 : 1981	Glossary of terms relating to agricultural produce processing equipment

3 TERMINOLOGY

3.0 For the purpose of this standard, the following definitions in addition to those given in IS 9981 shall apply.

3.1 Capacity

The quantity of the grains ground in kg/h into the quality as defined in **3.2** of the final product.

3.2 Product Quality

Quality of the finished product specified in the form of mean diameter of the particles obtained through sieve analysis and represented either in mm or in μm.

4 SELECTION AND SPECIFICATION OF BURR MILL

4.1 Selection

The burr mill shall be selected from the series production by the testing authority. For this purpose, the sample would be randomly selected from the available lot.

4.2 Specification and Other Literature

The manufacturer/supplier shall provide all literature, operation manual and specification sheet as given in Annex A duly filled in. The manufacturer/supplier shall indicate the maximum input capacity, rated capacity, output capacity and furnish any additional information which might be required to carry out the tests.

5 PRE-TEST OBSERVATIONS

5.1 Determination of Feed Quality

The feed to be used for testing burr mill shall be free from foreign matter such as chaff, stone particles, pieces of metals, mud particles and other agricultural grains. It should be graded before tests. Also the general condition of the feed such as, extent of damage due to insects, molds, fungi, etc, be reported.

5.2 Determination of Moisture Content

The feed shall be examined for moisture content in accordance with IS 4333 (Part 2). The moisture content shall be expressed in percentage wet basis.

5.3 Determination of Particle Size in Feed

Mean diameter of particles in feed shall be determined by standard sieve analysis and shall be reported in mm or in μm units.

6 RUNNING IN AND PRELIMINARY ADJUSTMENTS

6.1 The burr mill shall be installed on level and preferably on hard surface. All the adjustments shall be made in accordance with the recommendations of the manufacturer/supplier.

6.2 The burr mill shall be attached with a suitable prime mover preferably with an electric motor of capacity recommended by the manufacturer and auto voltage stabilizer. A suitable size wattmeter or energy meter shall be fitted. The power delivered to the burr mill may be supplied in the following ways:

a) Direct coupling the prime mover with the main shaft of the burr mill, or

b) Connecting the prime mover with the help of flat or V- belt and pulleys with the main shaft of the burr mill.

6.3 The burr mill shall be run-in without load before commencing of the tests. The running-in shall be carried out in accordance with the recommendations of the manufacturer/supplier. In the absence of the recommendations, the running-in shall be carried out for 30 min. During the period of run-in, adjustment for various functional components may be done. All the adjustments shall be done in accordance with the instructions manual supplied by the manufacturer/supplier.

7 GENERAL TESTS

7.1 Checking of Specifications

The specifications given by the manufacturer/supplier shall be checked and reported in the proforma given in Annex A.

7.2 Checking of Material

The material of construction of various components of the machine shall be checked and reported in data sheet given in Annex B.

7.3 Visual Observations and Checking of Provision for Adjustments

The observations and adjustments as given in data sheet at Annex C shall be made and reported.

8 TEST AT NO LOAD

8.1 Speed of Operation

The speed of operation of the main shaft and the feed agitator shall be measured and reported in rev/min.

8.2 Power Requirement/Energy Consumption

On running the burr mill at no load for at least half-an hour at the specified rev/min of the grinding surfaces, record the readings of the watt meter at an interval of one min for 15 min. In case of energy meter, the readings shall be recorded every 5 min for a period of 30 min.

NOTE — In case of energy meter if it is not possible to measure the reading in the specified time, the number of revolution of disc may be counted and converted into the number of units consumed.

8.3 Noise

The level of noise produced by the machine should preferably be recorded using a noise level meter and shall be reported in dB. The measurements should be done at radius of 2 m and 4 m from centre of the machine at 30° intervals.

8.4 The data of no load test shall be recorded in the proforma given in Annex D.

9 TEST AT LOAD

9.1 Test Material

The test material shall be cleaned seed or kernels. Wheat, sorghum, dehusked splits of chickpea and coriander shall be preferred. The quantity shall be sufficient to work the burr mill for a period of 90 minutes after reaching the normal working condition.

9.1.1 *Moisture Content*

The material for test shall have moisture content of 8 to 10 percent wet basis, or as specified by the manufacturer/supplier.

9.2 Operation and Collection of Data

The burr mill shall be operated at its specified speed and at appropriate clearance (between grinding surfaces) after achieving the normal steady state operation for 30 minutes at a feed rate slightly below 90 percent of its specified capacity. During the run period, collect the following samples and data in the format given in Annex E:

a) Three sets of samples of the flour at an interval of 10 min each;

b) The power requirement;

c) The speed of main shaft; and

d) Temperature of the feed, and that of the flour at an interval of 5 min each.

At the end of 30 minutes feeding, run the burr mill for some time so that practically no more material already fed comes out. In case the mill has a large casing, this should be opened to clear all the ground material resting inside. It should be weighed and recorded.

9.2.1 Repeat the test given at **9.2** for minimum of 2 times at 100 and 110 percent of the capacity declared by the manufacturer.

9.3 Analysis of Samples

Standard IS test sieves [*see* IS 460 (Part 1)] shall be used for sample analysis and the distribution be expressed in the following forms (*see* Annex E):

a) Average particle size,

b) Fineness Modulus, and

c) Uniformity Index.

9.4 Energy Consumption

Energy consumption for milling by the testing machine be specified in the form of specific energy for milling as follows:

$$Sp = \frac{[(P_{\text{load}} \times \eta_{\text{load}}) - (P_{\text{no load}} \times \eta_{\text{no load}})]}{Q}$$

where,

Sp = specific energy for milling, Wh/kg;

P_{load} = wattmeter reading (average) at load, W;

$P_{\text{no load}}$ = wattmeter reading (average) at no load, W;

η_{load} = efficiency of prime mover at load (assume 0.90, if not specified);

$\eta_{\text{no load}}$ = efficiency of prime mover at no load (assume 0.50, if not specified); and

Q = throughout of the machine, kg/h

9.5 Rise in Temperature of the Product

The rise in the temperature of the product at an interval of 1 min from start till 30 minutes of operation shall be measured with thermometer and recorded. The temperature rise would be calculated as:

Temperature rise (°C) = [Temperature of flour (°C) – Temperature of feed (°C)]

Lesser the rise in temperature measured after 30 min of continuous operation, better is the machine.

9.6 Rated Capacity

Select the feed rate at which specific energy for milling (*see* **9.4**) of machine is minimum.

10 LONG RUN TEST

The burr mill shall be operated for a minimum period of 24 hours at load. This period shall be covered in a maximum of 6 continuous runs of 4 hours each. During and after the operation, record of breakdowns, defects developed and repairing made shall be recorded in the format given in Annex F. The quality of the end product shall be analyzed.

ANNEX A

(*Clauses* 4.2 *and* 7.1)

SPECIFICATION SHEET

	To Be Filled By	
	Manufacturer	Testing Station
1 GENERAL		
a) Make		
b) Model		
c) Serial number		
d) Year of manufacture		
e) Recommended seeds/kernels for grinding		
f) Rated capacity, kg/h		
g) Rated speed of operation, rev/min		
2 POWER UNIT		
a) Type of prime mover		
b) Recommended power, kW		
c) Type of drive		
3 OVERALL DIMENSIONS		
a) Length, mm		
b) Width, mm		
c) Height, mm		
d) Total mass, kg		
4 MILLING CHAMBER		
a) Diameter, mm		
b) Width, mm		
5 MILLING SURFACES		
a) Material		
b) Diameter, mm		
c) Width, mm		

ANNEX B

(*Clause* 7.2)

DATA SHEET FOR MATERIAL OF CONSTRUCTION

Sl No.	*Component*	*Material*	*Confirming to IS*
i)	Body/Frame		
ii)	Grinding surfaces		
iii)	Grinding chamber		
iv)	Hopper		
v)	Feeder channel		
vi)	Outlet chute		
vii)	Clearance variation arrangement		
vii)	Others		

ANNEX C

(*Clause* 7.3)

DATA SHEET FOR VISUAL OBSERVATIONS AND PROVISIONS FOR ADJUSTMENTS

1 OBSERVATIONS

a) Adequacy of markings of direction of rotation;
b) Adequacy of protection of bearings against ingress of dust;
c) Adequacy of safety arrangements at moving parts;
d) Provision for lubrication;
e) Provision for easy changing of components requiring replacements;
f) Tightness of belts, nuts/bolts etc; and
g) Other observations.

2 PROVISIONS FOR ADJUSTMENTS OF

a) Feed-rate,
b) Speed of main shaft, and
c) Pressure or clearance between grinding surfaces.

ANNEX D

(*Clause* 8.4)

DATA SHEET FOR NO LOAD TEST

1 Test Data

Sl No.	*Item*	*Readings*						
		1	2	3	4	5	6	Avg
1.	Speed of operation, rev/min							
2.	Power requirement/Energy consumption							
3.	Noise level, dB							

2 Observations

a) Presence of any undue knocking or rattling sound,

b) Frequent slippage of belts,

c) Smooth running of shafts in respective bearings,

d) Any marked rise in bearing temperature, and

e) Other observation.

ANNEX E

(*Clause* 9.2)

DATA SHEET FOR TEST AT LOAD

1 TEST MATERIAL

i) Name

ii) Moisture content

2 PRIME MOVER USED

i) Efficiency of prime mover at no load

ii) Efficiency of prime mover at load

3 TEST DATA

Operation of the mill at 90/100/110% of the specified capacity:

Time	*Wattmeter Reading,* Watts	*Speed of main shaft,* rev/min	*Temp of feed,* °C	*Temp of flour,* °C	*Temp Rise* °C
(1)	(2)	(3)	(4)	(5)	(6)

4 ANALYSIS OF SAMPLE FOR DETERMINATION OF FINENESS MODULUS AND UNIFORMITY INDEX

Fineness modulus of flour would be determined through analysis of the observations obtained through sieve analysis. Indian Standard Sieves of mesh No.: 100, 70, 50, 40, 30, 20 and 15 would be used.

Fineness modulus (FM) = $\frac{1}{100}$ × sum of cumulative percent of material weight retained by the sieves

Uniformity index : Would be expressed in a ratio form specifically, the ratio of coarse : medium : fine particles in the product

Coarse aggregate : Rounded off weight of material retained by ISS 100, 70, and 50 mesh sieves

Medium aggregate : Rounded off weight of material retained by ISS 40 and 30 mesh sieves

Fine aggregate : The remaining part

Average particle size in feed, mm = $0.135\,(1.366)^{FM}$

ANNEX F

(*Clause* 10)

LONG RUN TEST DATA SHEET

1. Total running time
2. Continuous running time
3. Breakdowns, if any
4. Any major repairs conducted
5. Any other observation

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